a 12-in. column and then through dephlegmators, which cut out the heavier portions of the residue, the vapours and gases passing on into a condensing chamber, where they are compressed to 100 lb., and under this pressure go through the condensing coils. There seems to be an endothermic reaction taking place during the condensation by pressure, as a fall of temperature takes place where one would have expected a rise from the compression, and the liquid finally condensed contains not only gas in solution, but excessively volatile hydrocarbons evidently formed by the nascent gases attaching themselves to other molecules or polymerising. Such a spirit is far more complex than one formed by dissociation acting alone, as, besides the paraffins, olefines, and naphthenes, we also find aromatic hydrocarbons, acetylenes, and bodies like hemiterpene and terpenes.

During the past ten years several processes have been introduced in which steam or water has been introduced with the oil into the cracking ducts, the idea being that hydrogen from the water would affix itself to the heavy hydrocarbons and hydrogenate them into lighter hydrocarbons; to aid this action catalysts have been frequently used, nickel being the most popular.

The idea of the use of nickel as a catalyst is twenty-seven years old, as, in 1888, Ludwig Mond took an English patent, 12,608 of that year, in which he mentions the treatment of hydrocarbons, together with steam, by passing them through heated vessels containing fire-brick or iron oxide, and he states that if metallic nickel is used in place of the iron oxide, then only a moderate temperature is required.

About 1900, Sabatier and Senderens studied the action of nickel and other metallic catalysts on the hydrogenation of oils, and in the following years there were many more patents taken covering its use. Still later there were a large number of patents taken in America by Dr. Day, Ellis, Kayser, and others, dealing with the use of nickel as a catalyst.

Mond, Sabatier, and Senderens all recognised that such surface action as the nickel exercised took place only at temperatures below, at any rate, 300° C., but the more recent exploiters of the idea have drifted back to the temperatures one would use for cracking, not for hydrogenation.

Mr. Edgar A. Ashcroft has been doing some extremely interesting and highly suggestive work. Starting with the theory that the crude oil, as we obtain it from the well, represents a mixture in which the groups of atoms forming the molecule have, under the influence of temperature and pressure existing during the formation of the oil, arranged themselves as compounds in a proportion that has given a natural equilibrium, he suggests that if the crude oil be distilled so as to eliminate the lighter fractions and the residue be again subjected to the same temperature and pressure as that at which it was formed, a natural equilibrium will again be reached by the formation of a mixture akin to the original crude oil, from which more light fractions can be distilled. In the same way, when coal is destructively distilled, the gas and tar represent a molecular arrangement which is in a state of natural equilibrium, so that by taking a middle fraction of the distillation of such tar, say creosote oil, and subjecting it to heat and pressure, tar, with its low boiling hydrocarbons, middle fractions, and pitch, should be again formed. That this is so is seen from the following experiment.

Two hundred c.c. of creosote oil, distilling between 240° C. and 350° C., were heated in an autoclave up to 490° C., which gave a pressure of 100 atmospheres; on allowing to cool down 180 c.c. of tar and 5 litres of very rich gas were found to have been formed. The tar on distillation gave:—

	c. c.	
First runnings, up to 170° C. ...	10	Benzol, toluol, and solvent naphtha
Carbolic oils, 170°-240° C. ...	20	Phenols, naphthalene, and anthracene
Creosote oils, 240°-270° C. ...	20	
Anthracene oils, 270°-350° C. ...	20	
Pitch (very fine)	30	

representing an ideal benzenoid tar.

The extreme suggestiveness of this work, both from the theoretical and commercial point of view, will be at once apparent as offering a method by which the least valuable fractions of tar and crude oil can be converted into those for which there is a greater demand.

SERVI SERVORUM DEI.

It is not only His Holiness the Pope who is *servant of God's servants*; the title well becomes all who are saving or safeguarding the health of the British Expeditionary Force. To read the medical and surgical history of past wars—the American Civil War, or the Crimea, or the Franco-German War—is more pain than pleasure. To read what our Army Medical Service is doing now—a Committee has just been appointed for the writing of this history—will be not the least of the pleasures of peace. We have a foretaste of it, in the article which was published in the daily papers last week, by "an Eye-Witness present with general headquarters." He says, to begin with, that a war such as this, with so much hardship and exposure, would have cost our nation, a few years ago, an outbreak of disease that would have decimated our forces. He goes on to say that the low sick-rate in the Army to-day is due, partly, to the diligent instruction given of late years to our men in the first principles of health. "In the main, however, it is due to the preventive measures adopted by the medical service." And these preventive measures are of two kinds: those which prevent infection from gaining access to our men, and those which strengthen our men to withstand infection.

The article is mostly concerned, and no wonder, with typhoid fever. Yet, if we think of single cases, not of masses of cases, the protective treatment against tetanus, surely, is not a less achievement than the protective treatment against

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typhoid. Early in the war, the bad news came of many cases of tetanus; the heavily manured soil of France was full of tetanus; the very earth that our men were helping to defend was their enemy. It is a great blessing that a wounded man may indeed be safeguarded, with a dose of anti-tetanic serum, against this disease; and a great blessing that our men now are on soil which is fairly free from it.

But typhoid, after all, is the supreme test of the efficiency of an army medical service. We have learned of late years that the infection may be conveyed by flies, and by clouds of dust; we have learned also the danger of infection from mild, unsuspected cases, and from typhoid-carriers; we have left off thinking that typhoid cannot be spread without the help of a "polluted water supply." The present control of typhoid for our Army in France has been won by the bacteriologists; all honour to them:—

> Mobile bacteriological laboratories have been installed expressly for this purpose (the early detection of cases). Each laboratory consists of a motor-lorry fitted with a complete bacteriological equipment, and is in charge of a specially-trained officer, and an attendant of the Royal Army Medical Corps.

Moreover, it is the bacteriologists who discovered the protective treatment against the disease. On March 5 we learned what our Army owes to that treatment. Of fifty deaths from typhoid fever among our men on active service, forty-eight had occurred among the non-protected, one in a man protected, and one in a man partly protected. Nobody in his proper senses can doubt that Nature finds it easier to kill the non-protected than to kill the protected.

> It must not be forgotten that by far the most potent weapon in our armoury against typhoid fever has been forged by pathologists, before the war. Inoculation is the surest defence: and to its extensive use must chiefly be attributed the low incidence of this terrible disease in the British Army.

But the whole article ought to be read carefully, not in fragments.

Doubtless, when the hot weather comes, the work of safeguarding the Army's health will be no less arduous than it is now. For the present, let us be thankful for the splendid services rendered by men of science to our defenders, through all the bitter hardship and perils of the past nine months.

Stephen Paget.

THE USE OF ASPHYXIANTS IN WARFARE.

The use of asphyxiating gases by the Germans in forcing back the French lines to the north of Ypres has given rise to much conjecture as to the nature of the gases employed, and in a long article in a Sunday paper it is surmised that the gas used was carbon monoxide. The only foundation that can exist for such an opinion is that carbon monoxide is one of the most virulent gaseous poisons known, and that less than 1 per cent. in air rapidly proves fatal, but inasmuch as all the explosives in general use produce it in large quantities, the smokeless powders in use by England, France, and Germany, giving approximately 50 per cent. of the permanent gases formed as carbon monoxide, it is hard to believe that the enormous volume produced by firing the charge in the gun should have no deleterious effect on those using it, whilst the much smaller quantity given on the bursting of the shell should asphyxiate the enemy. The fact is, that carbon monoxide is slightly lighter than air, and when driven out by the explosion in a heated condition diffuses upwards so rapidly that scarcely a trace can be found at the breathing level, but when evolved underground in a confined space many accidents have been caused by its poisonous properties.

Moreover, carbon monoxide is in no sense of the word an asphyxiant, and one of its greatest dangers lies in the fact that air containing a poisonous amount can be readily breathed.

Later reports received on Monday and Tuesday make it evident that it was a true asphyxiant, such as sulphur dioxide, chlorine, or a mixture of the two that was employed, and that the fumes generated in front of the German trenches were borne down by a northerly wind upon the Allies. Some descriptions speak of the burning of some substance which gave a yellowish smoke and gases; others that the gases were contained in steel cylinders, the gases being conducted by hose-pipes some little distance in front of the trenches, whilst the men manipulating the cylinders wore divers' helmets, and the first German troops to charge over the gassed area wore smoke helmets or respirators. It is further probable that some shells containing a liquid giving gases of an asphyxiating character were also employed.

It seems to be clear from various descriptions that the gases floated close to the ground for a considerable distance, producing an effect of asphyxiation, which was felt as far as the Allies' second lines.

Both sulphur dioxide and chlorine would have produced the effects described, and the cylinders spoken of might have contained these gases in a liquefied form, whilst it is probable that shells used for asphyxiating purposes would be charged with chloride of sulphur which would itself decompose in moist air or in contact with water into sulphur dioxide, hydrochloric acid, and sulphur, or, if fired by the bursting of the shell, would give sulphur dioxide and chlorine.

Both sulphur dioxide and chlorine satisfy the requirements of being more than double the weight of air, and so might remain near the ground, diffusion being only slow, but it is difficult to understand how sufficient quantities of either gas were produced to render the air irrespirable at the distance of the Allies' lines from the German trenches.

RICHARD LYDEKKER, F.R.S.

Both zoologists and geologists lament the death on April 16 of Mr. Richard Lydekker, who had been for more than thirty years one of the most active workers in the natural history sciences. Born in 1849, of Dutch descent, he was educated at Cambridge, where he graduated

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